REMARKS

This Amendment is responsive to the Office Action dated November 25, 2005, in which Claims 1-17 were rejected. Claims 1, 3, 4, 9, 11, 12, and 16 have been amended. Accordingly, Claims 1-17 are pending in the application, and are presented for reconsideration and allowance.

Rejection Under 35 U.S.C. § 112

The Office Action has rejected claims 1, 9 and 16 under 35 U.S.C. 112, first and second paragraphs. The subject matter giving rise to these rejections has been removed from the claims. It is further believed that all subject matter that has been added by amendment is neither new nor indefinite, and would meet the requirements of 35 U.S.C. 112, first and second paragraphs.

Rejection Under 35 U.S.C. § 102

The Office Action has rejected claims 1-4, 7-12, and 14-16 under 35 U.S.C. 102(e) as being anticipated by U.S. Patent 6,512,994 (Sachdeva). This rejection is respectfully traversed.

The claims have been amended to further narrow the scope of the claims and more truly distinguish the patentable invention from the references cited. No new matter has been added.

Notwithstanding that each "marking 24" in Sachdeva is a 2-dimensional mark on a tooth, the Office Action states (page 3, paragraph 6) that Sachdeva shows these marks as a 3-dimensional control target because "these targets are used to control a 3-dimensional model creation process namely the scaling of the model." The independent claims have been amended to more clearly point out that the control target is separate from the intra-oral object and comprised of rigid lengths of material arranged in three dimensions with respect to the object to provide control features comprising vertices between the rigid lengths. (Support for this amendment is found on page 6, line 32 through page 7, line 5.) The "target" features in Sachdeva that the Office Action refers to are markings placed on the tooth (column 4, lines 35-40) to allow for scaling the orthodontic data to match the actual orthodontic size. In the present invention, the target comprises rigid lengths of material separate from the tooth; the target is closely controlled with respect to dimensions and provides reference features,

including the vertices between the rigid lengths, that are used to create the dental model according to the present invention.

As spelled out in the revised claims, the present invention differs significantly from Sachdeva. Some specific differences include the structure and use of the 3-dimensional intra-oral target, as defined above and in the amended claims. Furthermore, the 3-dimensional intra-oral target allows the use of photogrammetry to capture a precise series of overlapping images, from different positions, to construct an accurate model. It is clear, as discussed in more detail in the paragraphs below, that photogrammetry is clearly different from the single scaling factor used in Sachdeva.

There may continue to be some confusion with respect to Sachdeva's use of the terms "scaling" and "mapping" relative to the use of "photogrammetrically adjusting" in model building in the instant application. The process that is disclosed by Sachdeva involves resizing the image with respect to marks on a tooth and mapping the scaled data to a coordinate system anchored to certain orientation reference points in the mouth to "to produce an *enhanced* three-dimensional model of the orthodontic patient" (column 3, lines 64-67). The idea in Sachdeva is to show movement of teeth over the course of the orthodontic procedure, which may last months or years. The main point, however, is that Sachdeva starts with a 3D model from the scanning process and *enhances* the model by mapping the scaled data from the scanning process against the coordinate system. There is nothing in Sachdeva about building the model in the first place, only about *enhancing* it. This is significantly different from the "photogrammetrically aligning" method of the present invention, which is used to build the model. Moreover, it is the model building stage that is used to compensate for the deficiencies of the imaging process including the variable orientations of the capture positions. This is better understood by reference to the specification wherein the particular feature of photogrammetric alignment is discussed in detail, particularly on page 7, lines 22-31, as follows:

> The measurements are then processed in a photogrammetric adjustment stage 24 in order to compute the object-space coordinates of any object point which is imaged in the multiple overlapping images from varying camera orientations; this process utilizes the aforementioned least squares process described in the Manual of Photogrammetry, Fourth Edition, op. cit. Basically, this is a multiray stereo intersection process that is used to locate each

image point relative to the camera position. The result is a 3-dimensional model 26 of the tooth that has been processed with an analytical representation of the physical model which represents the imaging process of the sensor that captured the images.

As used in the amended claims of the present invention, photogrammetrically aligning refers to identification and measurement of control features on the image, and analytic adjustment of the image parameters using the control features to correct physical parameters. More specifically, paragraph (c) of amended claim 1 refers to "analytically generating a 3-dimensional model of the object by photogrammetrically adjusting image parameters *according to a multiray stereo intersection process by* using the measurements of the control features *to compute object-space coordinates of any object point which is imaged in the overlapping images from varying capture orientations*, thereby providing a photogrammetrically aligned 3-dimensional model of the object *that has been processed with an analytical representation of a physical model which represents the imaging process of the sensor that captured the images thereby* reducing image errors due to *the imaging process including* the variable orientations of the capture positions." (new words italicized, and based on the previous lines quoted from the specification). This is significantly different from any disclosure in Sachdeva, and particularly different from the use of the terms of scaling and mapping in the Sachdeva reference.

In yet another aspect of the instant invention, the target is independent of the scene. This means that the target is not only precisely known in terms of shape and dimension, it is known to be stable and therefore is not a source of error. It is not part of the patient, the tooth, or the imaging system. In that way it provides independent dimensional information that is used as control, i.e., the camera parameters, image measurements (of common features), and computed points which make up the three-dimensional model are all simultaneously adjusted (corrected) to the control information. It is used to remove error. What Sachdeva does is scale things so that they look the same, not remove error in the measurements or the model.

Dependent claims 3, 4, 11 and 12 have been amended to indicate that misalignment of the common features in the photogrammetrically aligned 3-dimensional model is determined relative to the images of the object by photogrammetrically projecting the model onto *one of the overlapping images* of

the object (amended material in italics). This is significantly different from Sachdeva, where there is reference to mapping a 2D image into a 3D model (col. 5, lines 50-58). However, there is no suggestion for photogrammetrically projecting a 3D model onto one of the 2D images in order to determine and correct misalignment of any control features.

Rejection Under 35 U.S.C. § 103

The Office Action has rejected dependent claims 5, 6, and 13 under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 6,512,994 (Sachdeva) in view of U.S. Patent 6,648,640 (Rubbert et al.). This rejection is respectfully traversed.

Applicant's previous amendment mailed October 15, 2004 pointed out specific differences between the Rubbert et al. reference and the present invention. These remarks are not repeated here for the sake of brevity. Neither Sachdeva, as distinguished above, or Rubbert et al., either in combination or individually, show all the features of the present invention. Therefore, the combination of these references do not make the claims of the present invention obvious.

The Office Action has rejected dependent claim 17 under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 6,512,994 (Sachdeva). This rejection is respectfully traversed.

In rejecting claim 17, which recites that the rigid control target has a saddle form resting over one or more teeth and the control features comprise vertices in the saddle form, the Office Action states that it would have been obvious to one of ordinary skill in the art to place any kind of rigid target on the tooth as a matter of design choice. We respectfully disagree. There is nothing in Sachdeva that would motivate the skilled person to adopt a saddle form, or any other kind of form that would be placed over the tooth as an independent target. Instead, we believe that a skilled person would seek a target that would be incorporated on or related to the physical dimensions and surface of the tooth, and thus would move and act dependently with the tooth, so as to accurately perform the requisite scaling. This is substantially different from the instant invention.

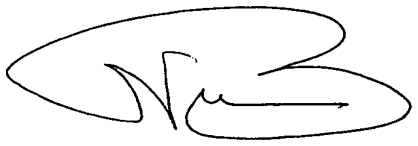
CONCLUSION

Dependent claims not specifically addressed add additional limitations to the independent claims, which have been distinguished from the prior art and are therefore also patentable.

In conclusion, none of the prior art cited by the Office Action discloses or suggests the limitations of the claims of the present invention, either individually or in combination. Therefore, it is believed that the claims are allowable.

If the Examiner is of the opinion that additional modifications to the claims are necessary to place the application in condition for allowance, he is invited to contact Applicant's attorney at the number listed below for a telephone interview and Examiner's amendment.

Respectfully submitted,



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If the Examiner is unable to reach the Applicant(s) Attorney at the telephone number provided, the Examiner is requested to communicate with Eastman Kodak Company Patent Operations at (585) 477-4656.